SULFUR CINQUEFOIL

Biology, Ecology and Management in Pasture and Rangeland

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Cover photo: Sulfur cinquefoil will begin blooming in early summer and can continue to bloom throughout the growing season if conditions are favorable.

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Sulfur Cinquefoil
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Origin and History

Sulfur cinquefoil *(Potentilla recta* L.) is a perennial forb native to Eurasia. It first appeared in North America before 1900 in Ontario, Canada. By the 1950s it had become widely established in eastern Canada, the northeast United States and the Great Lakes region .

The first specimen from Montana was collected in 1947 in Ravalli County. The second and third specimens recorded in Montana were from Lincoln County in 1949 and Mineral County in 1955. Identification of the species in additional counties was infrequent until the mid 1980s when an exponential expansion seems to have occurred. As of 1993, at least 30 counties were infested in Montana, 14 in Idaho, and 5 in northern Wyoming as well as Yellowstone and Glacier National Parks (Figure 1). Colonies that have expanded to dominate 100 to 1000 acres are not uncommon (Figure 2).

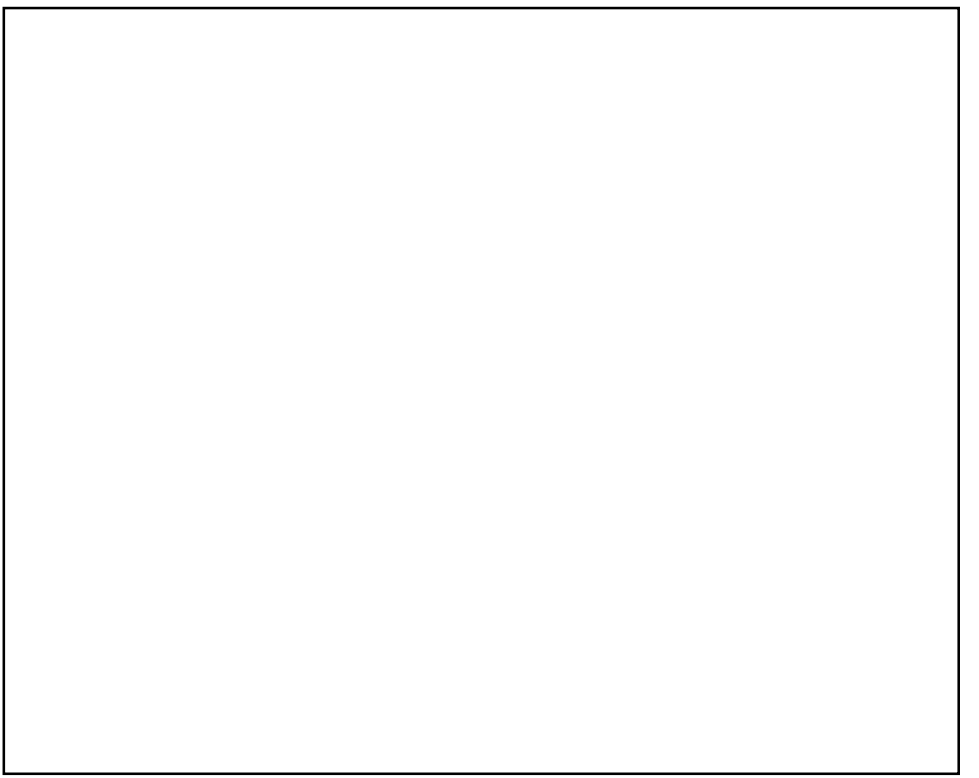

Figure 1: Counties in Montana, Idaho and Wyoming known to have been invaded by sulfur cinquefoil as of 1993.

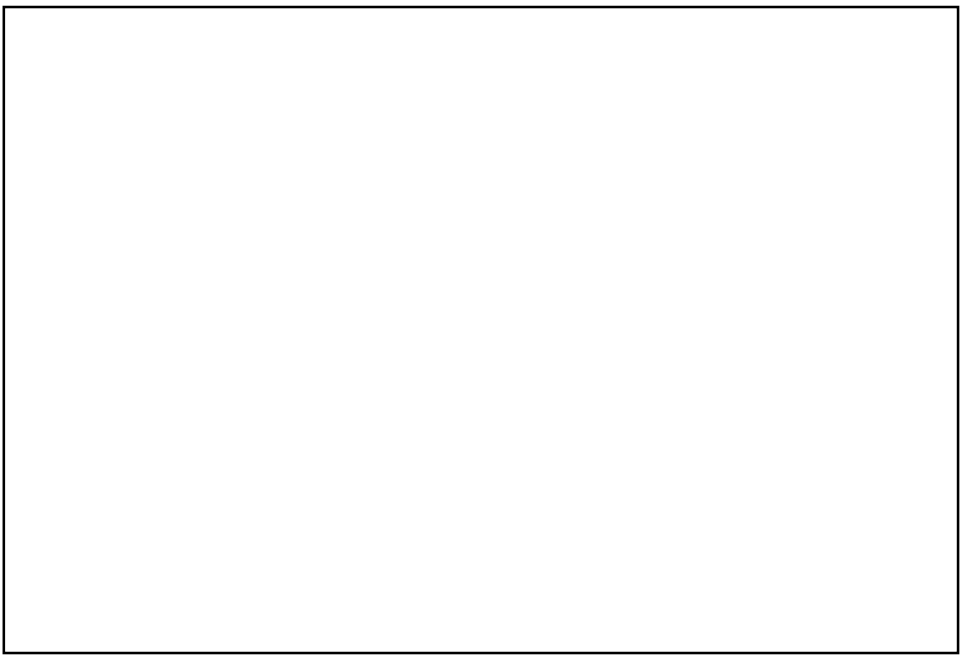

Figure 2 : Light yellowish-green patches on hillsides in early and mid-summer indicate sulfur cinquefoil infestations. [Photo taken in Missoula County]

Biology and Ecology

Sulfur cinquefoil is a long-lived perennial that begins growth early in the spring from a woody root (Figure 3). It reproduces by seed. There is one small ($^1/_{20}$ inch diameter), dry seed inside each fruit. A plant can produce 1,650 seeds per year.[1] Although it does not reproduce vegetatively, as old roots die in the center, new shoots grow from the edges and can form a ring-shaped clump of individual plants. Plants 20 to 30 years old have been reported in Michigan.

Sulfur cinquefoil produces one to several erect stems which vary from 12 to 28 inches in height. The compound leaves have five to seven leaflets arranged in a palmate pattern (Figure 4). Numerous leaves are attached along the length of the stem, but few of them grow from the base of the plant. The leaflets decrease in size, and the length of the leafstalks get shorter near the top of the stem. Uppermost leaves are attached directly to the stem. Stems and leafstalks are hairy. The hairs are $^1/_4$ inches in length and project outward at right angles (Figure 5).

The plant begins to bloom in late May and can produce flowers throughout the summer if growing conditions are favorable. The seed stalks are branched and produce many small flowers. The flowers normally extend above most of the leaves. Each flower has five pale yellow petals (Figure 4) and ranges from 0.6 to one inch in diameter. Both flowers and

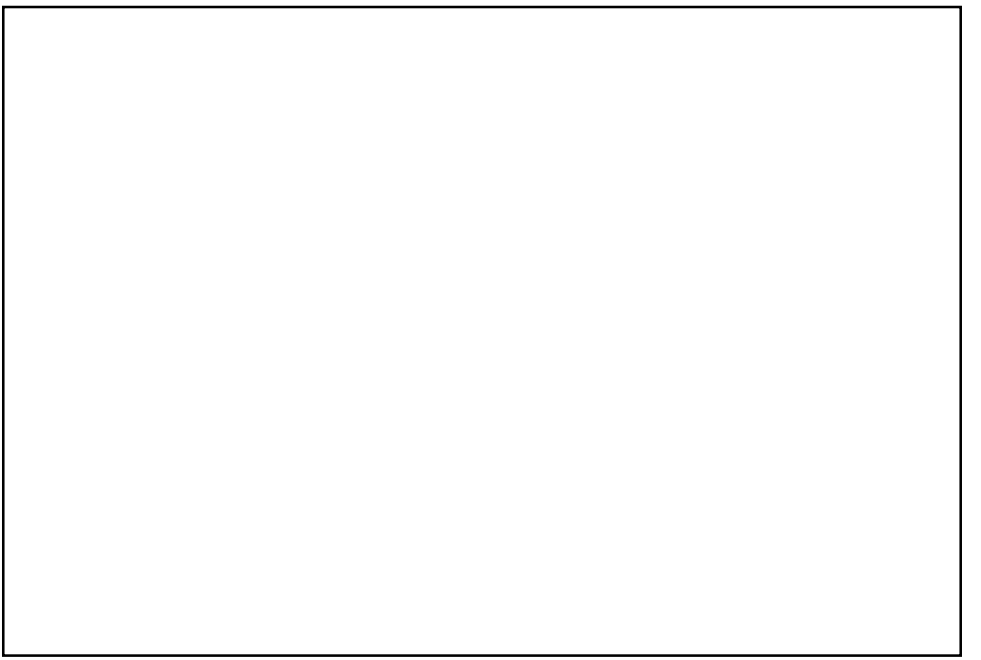

Figure 3. New leaves emerge from the root in early spring.

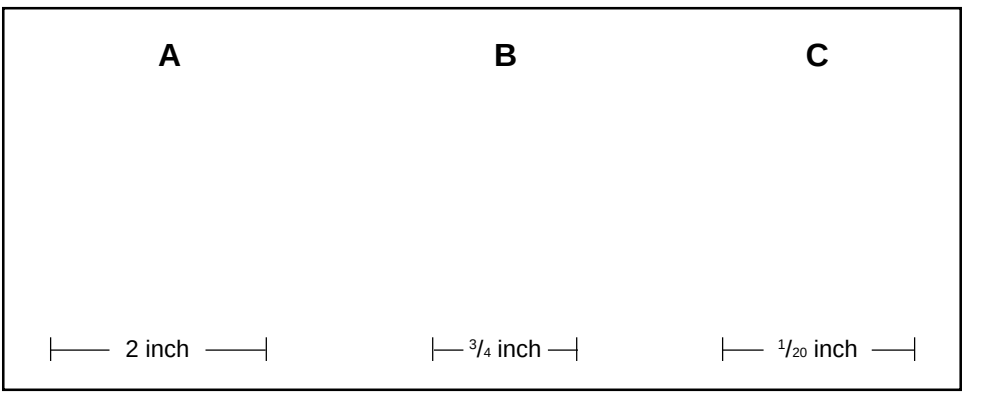

Figure 4. Palmate compound leaf with seven leaflets, A=Leaves, B=Flowers (sepals and petals), and C=Seed of sulfur cinquefoil (from Werner and Soule, 1976).

seed heads can be found on an individual plant later in the season (see cover). During fall and winter, thick patches of sulfur cinquefoil are brownish in color and easy to identify among the tan-colored dry grasses.

Twenty-seven species of *Potentilla* have been collected in Montana.[2] Sulfur cinquefoil is frequently confused with northwest cinquefoil (*Potentilla gracilis Dougl.*), a native plant occurring throughout the state (Figure 6).

There are many varieties of northwest cinquefoil. Northwest cinquefoil can be distinguished from sulfur cinquefoil by examining each of the following characteristics:

Northwest Cinquefoil (native)

1. short spreading hairs on stem and leaf stalk
2. few stem leaves, mostly basal leaves
3. dense, wooly, fine hair grows on the lower leaf surface
4. seed coat smooth
5. often has rhizomes
6. about 20 stamens
7. bright yellow flowers
8. dark green leaves

Sulfur Cinquefoil (introduced)

1. long hairs at right angle to leaf stalk and stem
2. numerous stem leaves, fewer basal leaves
3. lower and upper leaf surface has sparse coarse-stiff hairs
4. seed coat has net-like patterns
5. woody root, no rhizomes
6. 25 or more stamens
7. flowers paler yellow
8. yellowish green leaves

Sulfur cinquefoil is adapted to a wide range of environmental conditions. It grows in open grasslands, shrubby areas and open forest and logged areas, often in association with spotted knapweed. Disturbed sites such as roadsides, waste areas, logged areas and abandoned fields are easily invaded by the weed.

Sulfur cinquefoil is a strong competitor on some sites in western Montana. The plant produces more flowers and seeds in early—rather than in later—successional stages.[3] The

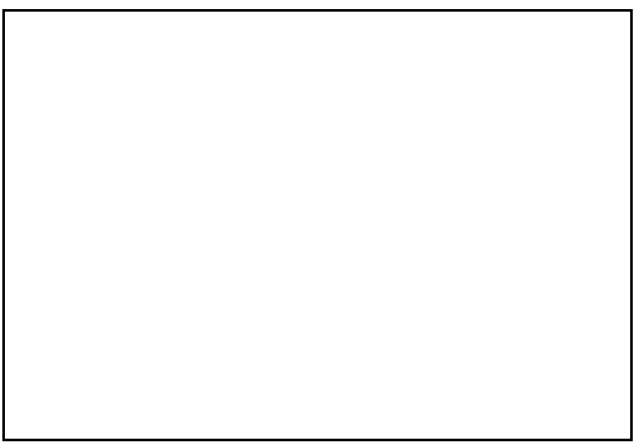

Figure 5. Hairs on the stem of sulfur cinquefoil (right) project outward at right angles from the stem and are longer than the hairs of northwest cinquefoil (left).

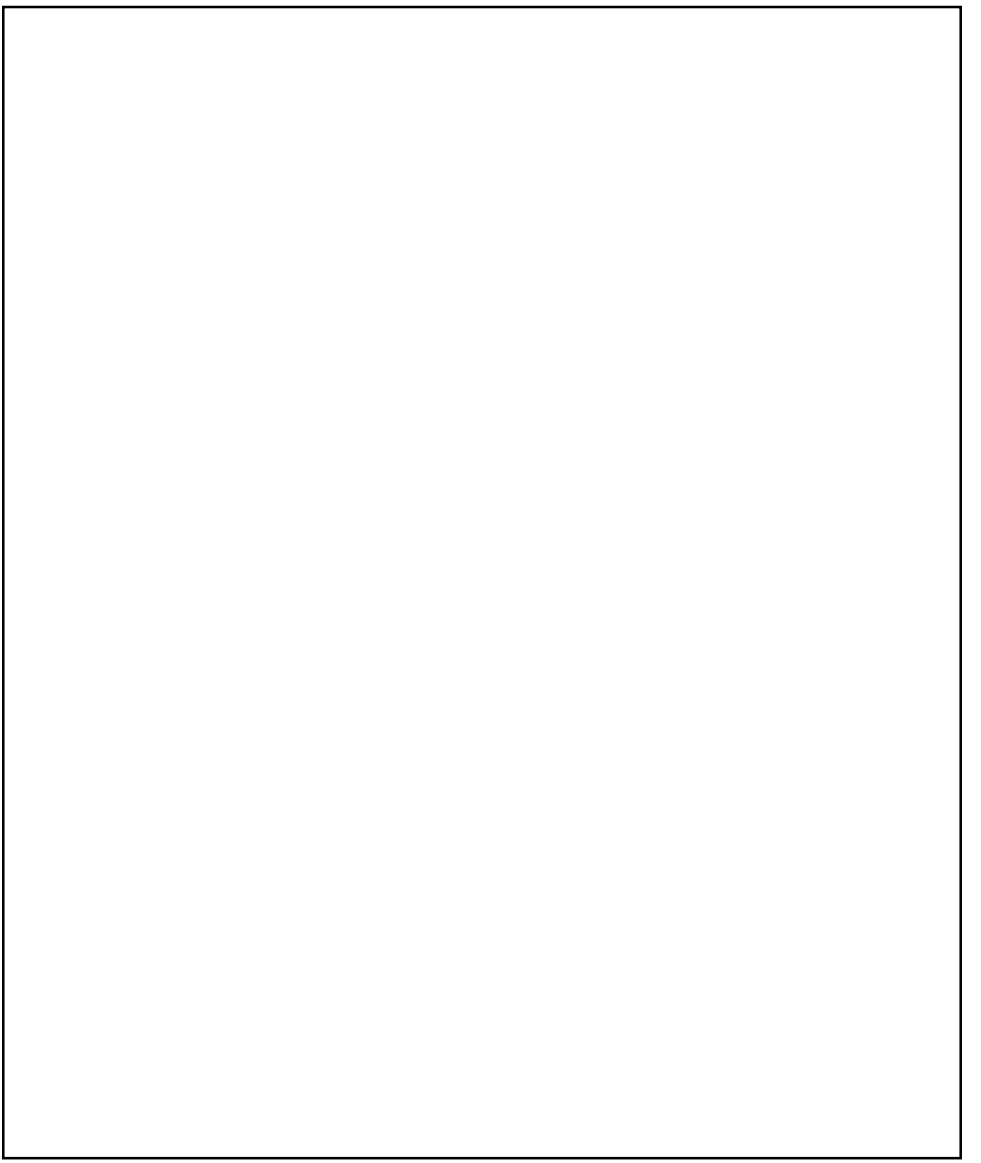

Figure 6. Growth form and seed (achene) of northwest cinquefoil (left) and sulfur cinquefoil (right).

reproductive strategy helps explain why a few scattered plants rapidly turn into a solid stand. According to Chuck Jarecki who has studied the problem for 20 years, sulfur cinquefoil can rapidly invade bluebunch wheatgrass rangeland that is in good condition and properly grazed.

Detrimental Effects

Sulfur cinquefoil is not known to be poisonous to other plants; however grass production is reduced through competition. The dense mono-cultures that the plant forms in western Montana are similar to those of spotted knapweed. A high tannin content makes sulfur cinquefoil unpalatable to most livestock and wildlife. In areas where sulfur cinquefoil and spotted knapweed grow together, cattle will selectively graze knapweed and leave cinquefoil (Figure 7). There are no known allergenic or poisonous effects to humans or animals.[4]

Control Methods

Individual plants and small patches of sulfur cinquefoil can be eliminated with either herbicides or hand removal. To date, large infestations have not been effectively controlled. Therefore, integrated management techniques that involve biological, cultural and chemical control methods are needed to manage large infestations of sulfur cinquefoil.

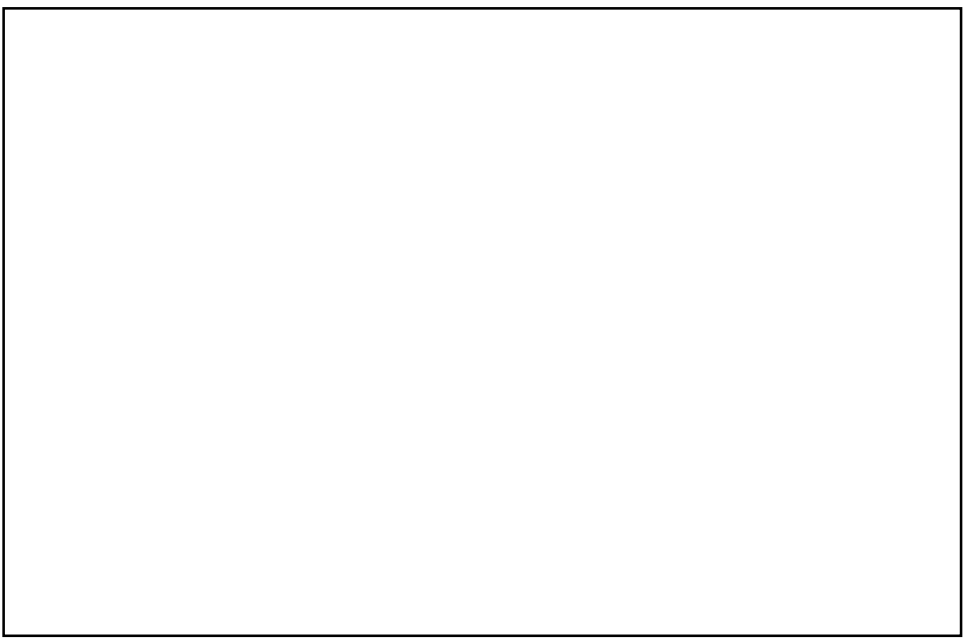

Figure 7. Cattle selectively grazed spotted knapweed while avoiding sulfur cinquefoil.

Mechanical Control

Mechanical methods include hand pulling, cultivation and mowing. Hand pulling or chopping is effective when the upper portion or crown of the root system is removed. On productive sites, an intensive management program that utilizes cultivation and annual crops will effectively control the plant.

Frequent mowing is not an effective management technique for sulfur cinquefoil. The massive, woody root system serves as a food storage organ and enables the plant to send up new shoots after mowing.

Chemical Control

Several herbicides and herbicide combinations can be used to control sulfur cinquefoil. They include Tordon*, Banvel** plus 2,4-D Amine, and 2,4-D Ester. These herbicides are selective for broadleaf weeds and generally do not harm grasses when applied at recommended rates. Tordon at 1 pint per acre provides the most effective long term control, and can be applied throughout the growing season (Figure 8). Banvel at 1 pint per acre plus 2,4-D Amine at 1 quart per acre and 2,4-D Ester at 2 quarts per acre are most effective when applied at the early plant growth stages (Figure 8). The period of time seedlings are controlled will be shorter with Banvel and 2,4-D than with Tordon. Although Ally*** has reportedly provided control at 0.8 oz. per acre, lower rates are not effective. Banvel alone does not provide satisfactory control of sulfur cinquefoil.

Sulfur cinquefoil re-establishes within two to four years depending on site conditions and herbicide characteristics. This suggests that cinquefoil seeds remain viable in the soil for more than four years. Treated areas should be monitored and herbicides applied as needed to stop weed re-establishment.

Biological Control

A total of 47 species of insects (beneficial and pest) are associated with sulfur cinquefoil in the northeastern United States.[5] Six species of root and crown boring moths and beetles have been found in sulfur cinquefoil in Montana.[6] Cinquefoils and strawberries are so closely related that some insects can feed on both. Three of the Montana insects are known strawberry pests. Host plant screening trials are planned for a new moth *(Tinthia myrmosaeformis)* and a new beetle *(Anthonomus rubripes* ab. *femoratus)* collected from sulfur cinquefoil in Europe.[7]

A rust fungus *(Phragmidium ivesiae* Syd.) is very widely spread on sulfur cinquefoil in Montana.[6] The leaves and stems of infected plants display bright orange spore clusters in the spring and black spore clusters in the summer.

**Trademark of DowElanco, **Trademark duPont de Nemours, ***Trademark of Sandoz LTD.*

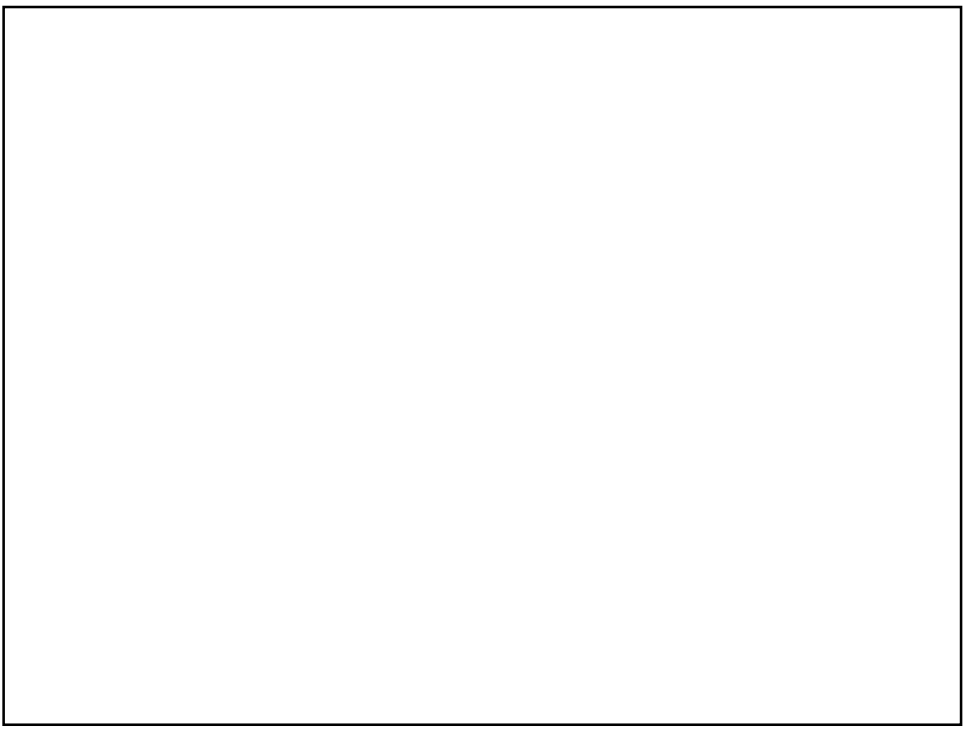

Figure 8: Sulfur cinquefoil control with four herbicides. Herbicides applied at four growth stages and evaluated one year after application.

Management Concerns

Sulfur cinquefoil has invaded thousands of acres of range and pasture in western Montana and threatens additional acreage. Its ability to produce large amounts of seed and survive under a wide range of growing conditions may allow the plant to spread as fast as spotted knapweed did during the 1970-1990 period. Cinquefoil's potential to spread is also enhanced by its low palatability to livestock and wildlife, and lack of natural pests (insects and pathogens).

Early detection and treatment is the key to slowing the spread of sulfur cinquefoil. Location and extent of current infestations need to be mapped. The challenge of controlling sulfur cinquefoil requires a cooperative effort of Montana citizens, civic leaders, land management agencies, and County Weed Boards.

Notes

[1]Werner, P.A., and J.D. Soule. 1976. “The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica L.*, and *P. argentea L.*” *Canadian Journal of Plant Science*, 56:591-603.

[2] Dorn, R.D. 1984. *Vascular Plants of Montana*. Mountain West Publishing, Cheyenne, WY. 276 p.

[3]Soule, J.D., and P.A. Werner. 1981. “Patterns of resource allocation in plants, with special reference to *Potentilla recta L.” Bulletin of the Torrey Botanical Club* ,108:311-319.

[4]Hermann, K. 1957. “The tannins of *Rhizoma tormentillae*.” Archiv der Pharmazie und Berichte der Deutschen Pharmazeutischen Gessellschaft 290(62):276-280.

[5]Batra, S.W.T. 1979. “Insects associated with weeds in the northeastern United States. II. Cinquefoils, *Potentilla norvegica* and *P. recta* (Rosaceae).” New York Entomological Society. 87:216-222.

[6]Rice, P.M. 1993. “Distribution & ecology of sulfur cinquefoil in Montana, Idaho and Wyoming.” Final Report. Montana Department of Agriculture, Helena, MT. 11 p.

[7]Story, J.M. Personal communication. Montana State University, Western Agricultural Research Center, Corvallis, MT.